CONSOLIDATED INFORMATION TECHNOLOGY SERVICES TASK ASSIGNMENT (TA)

1. **TITLE:** (D211) Geometry Laboratory (GEOLAB) Support
Maintenance Under Existing Task RFC025 - Advanced Engineering Environments Branch Lab Operations

SubTask No:	RFC025.01-Rev3	**SubTask Internal Control No:**	NONE
Task Area Monitor:		**Alternate Task Area Monitor:**	
NASA POC:			
Software Control Class:	LOW CONTROL	**Priority Level:**	ROUTINE
Type of Task:	Non-Recurring Task		

2. BACKGROUND

The GEOmetry LABoratory (GEOLAB) serves as a center resource to the LaRC research community in dealing with geometry and grid generation issues. The GEOLAB is an open shop facility with an on site technical staff available to collaborate with researchers or to take on geometry related tasks. The geometry modeling and grid generation support provided includes the production of accurate geometry definitions and numerical grids for Computational Fluid Dynamics (CFD), Computational Structural Mechanics (CSM), and other engineering analyses.

Based on data gathered within the last several years, the GEOLAB typically supports 30-60 production and consultation tasks a year with as many as 75-100 geometry models, geometry comparisons, structured and unstructured grids delivered as products. The majority of these tasks are production tasks of short duration and are accomplished within 2 to 6 weeks. The GEOLAB also develops software to facilitate geometry modeling and grid generation. Four of these locally developed codes are distributed to university and industry partners.

3. OBJECTIVE

The objective of this task is to provide services to the LaRC research community in the following areas:

- Create and modify numerical geometry models for use with grid generation software tools using either multi-block structured or unstructured techniques.

- Generate numerical grids for physics-based modeling and simulation.

- Analyze grid quality and validate surface modeling and grid generation fidelity and integrity. Demonstrate geometry and grid suitability using analytic solvers as required.

- Incorporate surface model measurements acquired by digital scanners into CAD compatible geometry models.

- Develop software and user interfaces to integrate the use of geometry tools into design and analysis processes.

- Provide consultation and training in the area of structured and unstructured grid generation and geometry modeling.

- Evaluate new emerging technology related to geometry modeling and grid generation.

- Assist in the transfer of LaRC developed technology to industry in a timely manner.

4. MAINTENANCE REQUIREMENTS

Contractor shall follow maintenance requirements listed for each software package in Section 6, Systems Application and Development Services.

5. GENERAL IT SUPPORT SERVICES

Services Specified Through Exhibit A:
General IT services and system administration support for the hardware and software used in the GEOLAB are provided through a separate CONITS task assignment. (RFC001 AEEB System Administration Support)

Maintenance of Software Developed By or For LaRC:
Software Identification: GridTool v3.5

LaRC Software Manager:

Software Class: Low

Software Description: GridTool is an interactive program that merges CAD and grid generation processes by delivering accurate CAD geometry in a form compatible with traditional grid generators and by supplying the needed information regarding patch definition and spacing requirements for unstructured grids. Both VGRID and FELISA grid generation software packages are supported. GridTool is a legacy code written in C that depends on the

Forms library and SGI GL library. This version of the code runs on SGI workstations and Mac workstations running OS X.

Level of Maintenance: Fix problems only.

Software Identification: Alchemize v4.7.3

LaRC Software Manager:

Software Class: Low

Software Description: Alchemize is a program used to convert structured and unstructured surface and volume grids between various file formats. Alchemize can be executed in an interactive mode or in batch mode from a command line or from within a script. Alchemize also has the ability to modify datasets by applying transformation matrices, swapping axes, and other functions that may be useful for preparing data for input into different applications requiring points definitions of surface geometry. (Legacy code written in C.)

Level of Maintenance: Fix problems only.

Software Identification: CSCMDO 5.4.4

LaRC Software Manager:

Software Class: Low

Software Description: CSCMDO (Coordinate and Sensitivity Calculator for Multi-disciplinary Design Optimization)
CSCMDO is a general purpose multi-block three-dimensional volume grid generator suitable for Multi-disciplinary Design Optimization. While CSCMDO is not capable of generating a grid from "scratch", it does offer modification and quality improvement capabilities for existing domain discretizations. Algebraic techniques are used to generate and/or modify block face and volume grids to reflect geometric changes resulting from shape optimization techniques. Volume grids are generated/modified in a batch environment and controlled via an ASCII user input deck. This allows the code to be incorporated directly into the design loop. CSCMDO is a legacy code written in C and is platform independent.

Level of Maintenance: Fix problems only.

Software Identification: security 1.0.0

LaRC Software Manager:

Software Class: Low

Software Description: GEOLAB Software Guardian that is a library that provides the node-locked licensing protection for all the GEOLAB developed software tools.

Level of Maintenance: Fix problems only.

Software Identification: REGI 1.1.1

LaRC Software Manager:

Software Class: Low

Software Description: REGI is a program written in C that is used to redistribute grid points within individual blocks in multi-block structured volume grids according to user supplied specifications.

Level of Maintenance: Fix problems only.

Customer Support and IT Consultation and Training:
The Contractor shall provide classes in the operation and use of surface modeling and grid generation software used within NASA to the LaRC community and their industry partners as required.

Any of the software listed in the GEOLAB software inventory are possible subjects for training classes, as well as the theory and techniques of surface modeling and grid generation. While the TAM will define the scope of the class, the Contractor shall be responsible for the class content, organization, handout preparation and reproduction, and the design of hands-on examples. The class materials and tutorials are considered deliverables of this task.

The GEOLAB hardware will be made available for the hands-on portion of the classes. The Contractor shall coordinate the hardware requirements and necessary configuration changes with the GEOLAB system administrators and the TAM.

The schedule for classes to be presented will be driven by requests from the LaRC research community and their industry partners. The class size will vary, but in general the expected number of students per class will be 1-12.

Generally the classes developed under this TA will be presented on site at LaRC. On occasion, it shall be necessary for the Contractor to provide a class off-site at an industry partner's location at the request of an LaRC customer.

The Contractor shall maintain a training log. The following information should be recorded for each student: name, organization or company, training date, and course attended. In addition, the contractor shall track and report costs incurred in providing training classes in the weekly labor report as a separate task.

Exceptions and Additional Requirements:
Maintenance

The maintenance activities for the software included in this section shall be performed in

accordance with the procedures outlined in the GEOLAB Software Project Management Plan. The Contractor shall track electronically bug reports and requests for enhancements for the software maintained in the Geometry Laboratory.

The Contractor shall track and report costs (hours) incurred in performing the maintenance of the software packages included in this section in the weekly hour report.

Software Archival

Several software packages will not be actively maintained in the GEOLAB any longer and shall be archived. These packages include: Volume, Surface, Surface2K, Rotor, OpenGridTool, and ABTools. All codes to be archived shall be tested to determine current state of the software (compiles and executes as expected). The software source, makefiles, test cases and data, documentation, and readme files documenting the current state of the software shall be archived together on masstore.

General IT Support Services Performance Metrics

Performance Standard: Task requirements for geometry and grid production tasks are met as specified in the task plan.

Performance Metrics:

Exceeds: All task requirements are met; all task deliverables are provided on original schedule and are accepted by the customer with no problems reported. The customer's requirements and/or expectations are exceeded.

Meets: Task requirements are met and all task deliverables are provided within modified schedule agreed upon with the customer. Customer is satisfied with the task deliverables and can use them in the manner intended.

Fails: Deliverables do not perform as documented in the requirements and customer expectations are not met. Customer is not satisfied and can not use the deliverable in the manner intended.

Performance Standard: Task and Subtask Plan documentation submittals and required reports are accurate, complete and received in a timely manner.

Performance Metrics:

Exceeds: Error free, complete, understandable, and submitted on schedule.

Meets: Minor errors or omissions exist that do not affect the use of the documentation or the meaning being conveyed, but submitted on schedule.

Fails: Major errors exist that make the documentation incomplete and/or not understandable or failure to submit documentation and milestones are missed.

6. SYSTEM AND APPLICATION DEVELOPMENT SERVICES

Project Title: GEOLAB Software Development Kit (SDK)

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel: None

Requirements:
The SDK is a collection of geometry and grid generation software algorithms and tools that supports both structured and unstructured grid techniques and includes the definition of core data types and functionality. In addition, several software applications have been developed on top of the SDK to facilitate geometry and grid generation tasks. These applications include Surface 2000, Volume 2000, TOG, and GridEx. The purpose of this work is to continue SDK development through feature enhancements, to maintain and enhance the existing SDK derived applications, and to leverage SDK capabilities in the development of new conceptual software applications focused on streamlining grid generation activities.

It is requested that the Contractor provide basic support for the development and maintenance of the GEOLAB SDK as required to meet specified task requirements.

Constraints:
The SDK enhancements should be added using the ANSI C or C++ languages in following with the SDK baseline for platform portability. Maintain/Enhance the cross-platform GUI subroutines using the WX widgets toolkit to serve as follow-on versions of the code for Linux and Win 32 platforms.

Software development under this area shall be done in accordance with the GEOLAB SPMP. All software changes shall be maintained using the GEOLAB CVS repository.

The Contractor shall track and report costs (hours) incurred in performing the maintenance of the software package included in this section as one subtask in the weekly hour report.

Acceptance Criteria:
The Contractor will demonstrate the added SDK capability within the existing applications cited above to the LaRC Software Manager or specified representative. The demonstrations will be conducted on a NASA provided test suite at a minimum. The resulting SDK enhancements should follow the modular paradigm established in the existing SDK baseline with additional data types and methods providing for general types and methods providing for general end-user application. This shall be demonstrated to the NASA representative through simple code fragments that demonstrate execution.

Project Title: Volume2K

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel:None.

Requirements:
Volume2K is an interactive program that is used to visualize, verify, and manipulate multi-block structured volume grids. A transfinite interpolation method is used with either linear or

arc-length based Soni blending functions. This program allows algebraic generation of surface and volume grids with interior control using specified fixed hard planes; grid quality assessment including negative volume, skewness, and stretch ratios; and viewing of multiple grid planes with varying rendering styles.

The Contractor shall fix known bugs, add enhancements, and maintain Volume2K to be operational within the GEOLAB computing environment on the SGI, Linux, and Win 32 workstations.

The Contractor shall maintain a software development outline. The outline shall be organized to include modifications and enhancements in the following categories: operational bug fixes, enhancements for ease of use, and additions of new features and functionalities. For each entry in the outline, a feature description, intended software version or revision number for release and an estimate of the approximate hours needed to accomplish the modification shall be included. The outline will be reviewed by the TAM and LaRC Software Manager and work priorities and constraints will be set before any the Contractor initiates any work on task elements from the outline.

The software development outline, review meeting notes, and acceptance emails shall be stored as specified in the GEOLAB SPMP.

Schedule - Win32 version complete by May 31, 2005

Constraints:
The enhancements made to this application should be added using the ANSI C and C++ language in following with the SDK baseline for platform portability. The WxWidgets toolkit shall be used in porting the code to Linux and Win 32 platforms.

Software development under this area shall be done in accordance with the GEOLAB SPMP. All software changes and version control shall be maintained in the GEOLAB CVS repository.

The Contractor shall track and report costs (hours) incurred in performing the maintenance of the software package included in this section as one subtask in the weekly hour report.

Acceptance Criteria:
The Contractor will demonstrate the added capabilities and enhancements made to this application to the LaRC Software Manager or specified representative.

Any SDK enhancements needed to support this application should follow the modular paradigm established in the existing SDK baseline with additional data types and methods providing for general types and methods providing for general end-user application. This shall be demonstrated to the NASA representative through simple code fragments that demonstrate execution.

Project Title: TOG

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel: None

Requirements:
TOG is a program that is used to build grid map files automatically to describe the connectivity of the blocks in complex multi-block structured volume grids.

The Contractor shall fix known bugs, add enhancements, and maintain TOG to be operational within the GEOLAB computing environment.

The Contractor shall maintain a software development outline. The outline shall be organized to include modifications and enhancements in the following categories: operational bug fixes, enhancements for ease of use, and additions of new features and functionalities. For each entry in the outline, a feature description, intended software version or revision number for release and an estimate of the approximate hours needed to accomplish the modification shall be included. The outline will be reviewed as needed with the TAM and LaRC Software Manager to set work priorities.

The contractor shall develop and document a test suite for TOG in concert with the software development.

The software development outline, review meeting notes, and acceptance emails shall be stored in the GEOLAB project directories.

Constraints:
The enhancements made to this application should be added using the ANSI C or C++ language in following with the SDK baseline for platform portability. The code shall be ported to Linux and Win 32 platforms as time and funding allow.

Software development under this area shall be done in accordance with the GEOLAB SPMP. All software changes shall be maintained within the GEOLAB CVS repository.

The Contractor shall track and report costs (hours) incurred in performing the maintenance of the software package included in this section as one subtask in the weekly hour report.

Acceptance Criteria:
The Contractor will demonstrate the added capabilities and enhancements made to this application to the LaRC Software Manager or specified representative. The demonstrations will be conducted using the Contractor developed test suite.

Any SDK enhancements needed to support this application should follow the modular paradigm established in the existing SDK baseline with additional data types and methods providing for general types and methods providing for general end-user application. This shall be demonstrated to the NASA representative through simple code fragments that demonstrate execution.

Project Title: GridEX

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel: None

Requirements:
The purpose of this task is to provide assistance in the development of the GridEX framework through three primary thrusts: general CAD support, including the construction of native solid model test cases for the framework; software evaluation and testing; and software documentation.

It is required that incremental testing and evaluation be provided throughout the continuing development of the GridEX framework. The testing shall include the examination of emerging capability as well as the verification of modifications and improvements made to the baseline software.

CAD support is required for the creation of solid models to be used as test cases for the framework, and for the repair and simplification of geometry provided by GridEx users. It is requested that a complex geometry test case, on the order of the Energy Efficient Transport (EET) powered high-lift configuration, be constructed in the Unigraphics CAD system.

Maintenance of the GridEX User's Manual is also required to reflect changes in software operation and functionality. The documentation is currently maintained electronically as HTML and it is requested that this medium be used in future revisions.

Deliverable items shall include source code and build scripts for test cases, test case geometry in the form of native CAD parts, test results, written evaluations (outlines acceptable), and the User's Manual in electronic form.

Constraints:
Software testing under this area shall be done in accordance with the GEOLAB SPMP and LMS 5528.

Software test cases shall be delivered as distinct source code modules where possible. It is required that these test cases be maintained within the GEOLAB Concurrent Versions System (CVS) repository.

The Contractor shall track and report costs (hours) incurred in performing the requirements included in this section as one subtask in the weekly hour report.

Acceptance Criteria:
Any SDK enhancements needed to support this application should follow the modular paradigm established in the existing SDK baseline with additional data types and methods providing for general types and methods providing for general end-user application. This shall be demonstrated to the NASA representative through simple code fragments that demonstrate execution.

Geometry created as test cases shall be created as manifold B-Rep solids suitable for use in the GridEX software package. The LaRC Software Manager will specify the CAD tool to be used to verify the geometry as a manifold solid for each geometry to be produced.

Project Title: CDUCT-LaRC

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel:The Contractor shall develop in support of the Quiet Aircraft Technology (QAT) program a framework within which engine noise calculations can be performed by combining automatic grid generation, background flow field computation, and noise propagation and radiation models. The CDUCT-LaRC code should have the capability of generating the orthogonal grids and compressible background flow computation needed for aeroacoustic calculations for a cylindrical duct geometry. The code must be validated using analytic and experimental data.

Requirements:
Requirements:
CDUCT-LaRC is a modular code that calculates the propagation and radiation of given acoustic sources ahead of the fan face or aft of the exhaust guide vanes in jet engine inlets or bypass ducts, respectively. The code includes modules for automatic grid generation, mean flow (CFD) calculation, duct propagation, acoustic radiation, and post-processing. To further enhance CDUCT-LaRC development, GEOLAB is requested to provide support in the following areas:

· Automatic grid generation

o Maintain/Enhance automatic grid generation capabilities for use within the grid generation module of CDUCT-LaRC.

o This module will include the capability to automatically generate mean flow grids (as orthogonal as possible) for an engine inlet or by-pass duct containing zero, one, or two internal bifurcations/pylons. User input will be in the form of multi-block PLOT3D ASCII surface files.

o Develop this functionality in the form of a library callable from the CDUCT-LaRC GUI or a batch program.

o Any revision/modification of the code must successfully generate acceptable inviscid mean flow grids for the test cases provided in the CDUCT-LaRC distribution. A grid is considered acceptable if it passes normal GEOLAB grid requirements regarding overall grid quality and metrics (e.g. no negative volumes, skewness, stretching).

o Generate and maintain user documentation.

· Mean flow calculation

o Maintain/Enhance steady compressible CFD capabilities suitable for use within the mean flow module of CDUCT-LaRC.

o This module will include the capability to perform compressible mean flow computations for engine inlets or by-pass ducts containing zero, one, or two internal bifurcations/pylons. The only user inputs required will be a computational grid and flow conditions.

o Develop this functionality in the form of an executable, as well as a library callable from the CDUCT-LaRC GUI or a batch program. A sample executable demonstrating the use of the library for the various test cases will also be included.

o Any revision/modification of the code must successfully generate acceptable results for the test cases provided in the CDUCT-LaRC distribution. Results are considered acceptable if the code runs to completion and produces sensible flow values that do not deviate from previous test results within machine tolerances.

o Generate and maintain user documentation.

· GUI development

o Maintain/Enhance the cross-platform GUI for CDUCT-LaRC GUI using the WX widgets toolkit (as specified by GEOLAB development practices) to serve as follow-on versions of the code. The GUI shall provide access to each of the library modules comprising CDUCT-LaRC, as well as a grid viewer for graphical specification of impedance zones.

o Maintain/Enhance the viewer within the CDUCT-LaRC GUI to allow graphical specification of liner locations. The viewer should allow generation and/or modification of neutral map files suitable for use within the batch and graphical versions of the propagation module. Future versions will include the ability to calculate treatment surface area.

o Generate and maintain user documentation that describes the use of the GUI and connection to batch input files described in the current documentation.

Projected completion dates:

Version 2.0 release: October 2005.

Constraints:
Constraints:
All software developed for CDUCT-LaRC by the Contractor under this area shall be done in accordance with the GEOLAB SPMP.

All software shall be written in ANSI C or C++ for Linux and Win 32 platforms. Any exceptions to this will be by mutual consent between the LaRC POC and GEOLAB. It is required that all software be maintained within the GEOLAB Concurrent Versions System (CVS) repository.

Monthly progress reports outlining the current and completed work will be electronically submitted to the LaRC POC at the end of each month. These reports should also highlight the work priorities and schedule for the upcoming month. The LaRC POC will respond to each monthly report and specify any changes/modifications to work priorities.

The Contractor shall track and report costs (hours) incurred in performing the maintenance

of the software package included in this section as one subtask in the weekly hour report. The costs incurred shall not exceed the initial amount agreed upon. Any additional costs above that value shall require prior approval of the LaRC POC.

Acceptance Criteria:
Acceptance Criteria:
In addition to individual component criteria mentioned above, the Contractor will demonstrate to the LaRC POC use of the CDUCT-LaRC code to accurately generate the benchmark results of the test cases provided in the CDUCT-LaRC distribution.

Project Title: RDUCT-LaRC

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel:The contractor shall develop a rectangular duct propagation and radiation code called RDUCT-LaRC based on the CDUCT version 1 code. The contractor shall validate the code using analytic and experimental data. The products to be delivered include: complete and validated RDUCT-LaRC source code, test cases, code validation results, and user documentation describing installation and usage. The experimental data for the validation of the RDUCT-LaRC code will be obtained from a new experimental facility to be designed and built by the Aeroacoustics Branch, AAAC. The Contractor shall utilize existing computational codes in use at LaRC to help determine design parameters for the duct elements including the transition from the air supply fan to the cross section of the test duct, the diffuser downstream of the test duct section, boundary layer control system, and fluid flow sections. The Contractor shall provide this information to the mechanical designers so these elements can be incorporated into the overall test apparatus.

Requirements:
Requirements:
Most of the general requirements for the code development portion of the task will be met through
the GUI (under development as a subset of CDUCT-LaRC), except:
In addition to conventional liners, the code must be sufficiently flexible to be used to estimate
the acoustic performance of curved ducts with passive noise control elements, active elements
and hybrid elements.
CDUCT is based on a parabolic approximation to the (elliptic) convected Helmholtz equation,
which describes the propagation of sound within ducts in the presence of background flow. As
such, accurate prediction of the acoustic performance associated with ducts of rectangular cross-section
is limited to low order modes. The code is currently being modified to handle higher order modes. This capability is essential for the proper prediction of noise propagation within curved

ducts.
All of the requirements for the experimental facility upgrade aspect of the task have been met.
The following systems/components have been designed and extensively analyzed to assess their
aerodynamic performance:
- A flow delivery system upgrade containing four major flow transition elements: diffuser/ silencer, circular to rectangular transition, 90o bends (2), and a rectangular transition.
- Test bed including ducts of varying curvature, and a diffuser/acoustic termination.
Numerous reports on the design and performance of these systems have been submitted to the
customer. Data from these reports have been used by the facilities management office to generate
preliminary construction drawings.
Future Work:
- Development of RDUCT-LaRC will continue with the implementation of a formulation to predict the correct behavior of higher order acoustic modes. Other potential modifications include
the addition of viscous effects and the implementation of active and hybrid noise control models.
It is not known at this time if these modifications can be implemented into the code without drastic
changes to the solution procedure (i.e., rewriting the code). Development of the GUI will continue.
- The preliminary design for the ANRF upgrade will require modifications to accommodate the
high-performance silencer recently identified by the customer. This necessarily involves a reassessment
of the aerodynamic and acoustic performance of some of the components.

Constraints:
Constraints:
All software developed for RDUCT-LaRC by the Contractor under this area shall be done in accordance with the GEOLAB SPMP. All software changes and version control shall be maintained in the GEOLAB CVS repository.

All software shall be written in ANSI C and C++ for Linux and Win 32 platforms. Any exceptions to this will be by mutual consent between the LaRC POC and GEOLAB. Monthly reports outlining current and completed work will be electronically submitted to the laRC POC at the end of each month. These reports should also highlight the work priorities and schedule for the upcoming month. The LaRC POC will respond to each monthly report and specify any changes to work priorities.

The RDUCT-LaRC code shall be developed to be user friendly. A graphical user interface (GUI) will be included that guides the user for input data, recommending reasonable ranges of input data and showing the default values of input data. The GUI shall be consistent with other GEOLAB products.

The Contractor shall track and report costs (hours) incurred in performing the maintenance of the software package included in this section as one subtask in the weekly hour report.

The costs incurred shall not exceed the initial amount agreed upon. Any additional costs above that value shall require prior approval of the LaRC POC.

Acceptance Criteria:
Acceptance Criteria:
In addition to individual component criteria mentioned above, the Contractor will demonstrate to the LaRC POC use of the RDUCT-LaRC code to accurately estimate the acoustic performance of the rectangular duct geometry case. Additional test cases will be proposed by the LaRC POC.

Project Title: Geometry Integration and Code Development for Acoustic Scattering Software

LaRC Software Manager:

Software Software Control Class: Low

Responsibilities of Contractor and LaRC personnel:Objective: Develop a fast computer code for the prediction of engine noise scattering from the wings and fuselage of an aircraft within a flow field.

Requirements:
Requirements:

The solution method [redacted] using the Equivalent Source Method is being used as the basis for the fast acoustic scattering code (FSC). The FSC predicts the scattering of incident noise by an arbitrary body immersed in an inviscid flow field. The code, based on linear acoustics, utilizes the equivalent source method for solving an exterior Helmholtz equation boundary value problem.

The contractor shall enhance the code to include:
- Implementation of non-uniform background flow
- Determination of equivalent source placement effects
- Calibration/comparison with duct acoustics code CDUCT
- Full scale frequency capability for axisymmetric nacelles
- Increase excitation frequency limits for arbitrary bodies
- Code reorganization and porting to FORTRAN 95 using dynamic memory allocation, increased modularity for ease of maintenance and enhancements, and error trapping.

Constraints:
All software developed by the Contractor under this area shall be done in accordance with the GEOLAB SPMP. Software changes and version control shall be maintained in the GEOLAB CVS repository.

The FAST ESM code shall be developed to be user friendly. A graphical user interface (GUI) will be included that guides the user for input data, recommending reasonable ranges of input data and showing the default values of input data. The GUI shall be consistent with other GEOLAB products.

The Contractor shall track and report costs (hours) incurred in performing the maintenance of the software package included in this section as one subtask in the weekly hour report. The costs incurred shall not exceed the initial amount agreed upon. Any additional costs above that value shall require prior approval of the LaRC POC.

Acceptance Criteria:
Acceptance Criteria:
In addition to individual component criteria mentioned above, the Contractor will demonstrate to the LaRC POC use of the FAST ESM code to accurately estimate the acoustic scattering from a realistic airplane geometry. Test cases will be proposed by the LaRC POC.

Version 2.0 will be released November 15, 2005.

7. WORK-AREA SPECIFIC SERVICES

Work Area Title: GEOLAB Operational Support

LaRC Manager:

Work Area Description: The Contractor shall provide support to ensure the efficient operation of the GEOLAB.

Work Area Requirements: The contractor shall make initial contact (via phone or email) with a new customer within 24 hours of receipt of request from the LaRC manager.

The contractor shall consult with customers as required to provide input based on past experiences with regards to possible strategies and limitations of available software tools and techniques for geometry modeling and grid generation.

The contractor shall provide demonstrations of software packages that are part of the GEOLAB software inventory as required to potential customers.

The Contractor shall test equipment and software systems after installation to make sure they are in working order and ready for use within the GEOLAB computing environment. This includes installation of revisions of any of the software listed in the GEOLAB software inventory as well as newly acquired COTS or GOTS software. The Contractor shall work with the GEOLAB system administrators assigned under TA-RFC001 to integrate new software into the GEOLAB.

The Contractor shall track electronically software bug reports and requests for enhancements for commercial and locally developed software packages used in the GEOLAB.

The Contractor shall provide a GEOLAB deliverables summary monthly to the TAM. The metrics to be reported shall include, but are not limited to: list of completed products delivered, number and affiliation of trainees attending classes, number of software transfers processed, and the number and nature of consultation tasks performed. In addition, the Contractor shall provide a weekly labor report for all the active subtasks and

work areas under this TA.

The Contractor shall maintain the GEOLAB SPMP in accordance with LMS-CP-5528. The modified SPMP is to be delivered to the TAM for approval as the document evolves. The GEOLAB SPMP should include a plan for maintenance, operation, testing, and configuration management in addition to software development. The current GEOLAB SPMP (version 1, revision 2) has been uploaded and attached to this TA in Section 19.

The Contractor shall track and report costs (hours) incurred in performing the work outlined in this section included in this section as one subtask in the weekly hour report.

Work Area Title: Staff Training

LaRC Manager:

Work Area Description: The contractor staff shall acquire and maintain proficiency in the software tools used within the NASA research community in performing surface modeling and grid generation.

Work Area Requirements: The contractor shall maintain proficiency at an expert level in the use of ICEM/MULCAD, ICEM/PADAMM, Gridgen, GridTool, VGRID, Imageware FreeForm Modeler (Surfacer), Geomagic and at least two of the following CAD tools - Pro/Engineer, Unigraphics, or Catia 5. The contractor shall maintain a working knowledge of the remaining software tools in the GEOLAB software inventory.

The Contractor shall develop additional expertise in the technology area of unstructured grid generation so as to have more than one GEOLAB team member at the expert level. At least two team members shall be identified and trained in the use of VGRID v4.0 and GridEX.

The Contractor shall track and report training costs incurred as a separate task in the weekly task labor report.

Work Area Title: Consultation

LaRC Manager:

Work Area Description: The Contractor shall provide consultation to GEOLAB customers within the scope of GEOLAB functions described in the Objective Section of this TA. These consultation tasks may be initial investigations needed to determine requirements for large complicated surface modeling and/or grid generation tasks, data format conversions, data verification, data refinements, brief consultations with customers in the use of software and hardware for surface modeling and grid generation.

Work Area Requirements: Any consultation task requiring more than 8 task hours to complete shall be defined and tracked as a separate production subtask.

The Contractor shall track and report costs (hours) for each organization receiving consultation services as separate tasks in the weekly labor report. This report shall be an informal log delivered electronically as an MS/Excel spreadsheet. The log shall include the researcher's name; the nature of the consultation; the number of hours spent; and a list of any products delivered.

Work Area Title: Technology Transfer

LaRC Manager:

Work Area Description: The Contractor may assist external industry and university customers in integrating GEOLAB supported analysis tools and methods into their processes. The tools that shall be distributed and supported are: GridTool, Alchemize, Volume2K, and CSCMDO. Additional tools may be identified by the TAM.

Work Area Requirements: The Contractor shall coordinate the transfer of executable modules with external customers approved by the TAM and the DAIB Software Release Agent according to LaRC software distribution procedures described in LMS-CP-1724. The Contractor shall report in the monthly summary the number of software transfers for each of the four codes to be distributed under this work area.

With concurrence of the TAM, the Contractor shall demonstrate GEOLAB software capabilities using GEOLAB examples or examples provided by the customer as a proof-of-concept test for external customers.

The Contractor shall track and report costs (hours) incurred in performing the work outlined in this section included in this section as one subtask in the weekly hour report.

Work Area Title: Geometry Modeling and Grid Production

LaRC Manager:

Work Area Description: The Contractor shall provide geometry modeling and grid generation services to the LaRC research community within the scope of GEOLAB functions. Tasks performed within the GEOLAB may include: grid generation (structured or unstructured), reverse engineering of surfaces, surface or grid modifications, geometry mappings, geometry data validation and comparisons, and data archival. Geometry and grid products required in subtasks may include: surface descriptions of aerospace configurations or experimental hardware, surface grids, volume grids, map files, and solver input files, and documentation.

Work Area Requirements: Requirements will be determined separately for each subtask by the TAM and/or GEOLAB customer in collaboration with the contractor to select between possible alternative approaches.

The Contractor shall document the technical approach for each project in a Subtask Plan. The completion date and delivery schedule for each subtask shall be documented in the Subtask Plan. In general each subtask plan shall be delivered to the TAM and GEOLAB customer for approval within 3-5 work days of the initial technical discussions held to discuss alternative solution approaches. Each Subtask Plan shall include: the Contractor's technical lead, project title, the scope of the work and requirements as understood from the customer's request and technical discussions, proposed method for satisfying requirements, resources to be used, baseline data to be used, list of deliverable items, test plan, acceptance criteria, list of items to be placed under configuration management, and risk analysis.

At a minimum, the following items shall be delivered for each subtask project: subtask plan with a cost estimate, monthly status reports, geometry/grid or software products, verification and diagnostic reports per deliverable, geometry/grid product readme file or software documentation, test cases, and weekly labor report. The readme files associated with set of each deliverables shall describe the pertinent features of the products and the assumptions and changes incorporated into this delivery.

The contractor shall verify task deliverables through diagnostics and execution of appropriate test cases designed to identify errors that may occur during production. Prior to the delivery of any product, the Contractor shall evaluate the product against the list of acceptance criteria provided by the GEOLAB customer and documented in the subtask plan. Problems and inconsistencies in the product shall be reported and discussed with the GEOLAB customer and TAM. Additional work to resolve the problems and checks will be performed until the product meets the task requirements.

Generally complex grids, geometry models, and software products that are deliverables of production tasks shall be delivered in a joint review involving the GEOLAB customer and the Contractor personnel assigned to the task. If the customer is not local or the product is sufficiently straight-forward that it is easily understood, the joint review can be waived.

Documentation supporting the deliverables shall be complete and accurate. At a minimum, the documentation shall be an accompanying text file that describes the intended purpose and pertinent features of the grid or geometry specified as a deliverable. Flow solver map files, images, drawings, and diagnostics from design or analysis software may be included as documentation. Any approximations or assumptions made while executing the task, as well as any restrictions in the use of the data produced, shall be noted.

Errors or problems observed shall be noted and documented. Corrections shall be made in a manner agreed upon by the Contractor and the GEOLAB customer prior to acceptance. Additional reviews shall be conducted prior to acceptance to demonstrate the resolution of the identified problems.

If the GEOLAB customer or TAM finds the product is acceptable based on hands-on testing, demonstrations, diagnostics, and document review, an acceptance email will be generated by the customer and stored by the Contractor as a record of the acceptance of the delivered product.

Delivered software and geometry products must be operational in the GEOLAB computing environment at a minimum. Additional requirements for installation operation, and maintenance of task products may be specified by GEOLAB customers and shall be documented in the Subtask Plan prepared by the Contractor.

The Contractor shall propose a configuration management plan for use with GEOLAB production tasks. The naming convention and storage locations (mass storage, GEOLAB workstation cluster, tape, CD, etc.) shall be included in the plan. This configuration management plan should be submitted along with the TA task plan.

The Contractor shall track and report costs (hours) incurred in performing the work outlined in this section as separate subtasks in the weekly hour report.

Work Area Title: Hardware and Software Evaluations

LaRC Manager:

Work Area Description: The contractor shall perform evaluations of software and hardware that show potential to enhance the surface modeling and grid generation capability at LaRC. The tools to be evaluated will be identified by either the TAM or the Contractor. The

TAM will specify a not to exceed cost for each evaluation undertaken.

Work Area Requirements: When evaluating software and hardware for use in the GEOLAB, the Contractor shall assess the following features: capability vs. cost, data format requirements, adherence to data format standards (IGES, STEP, STL, VRML, PLOT3D, etc.), cross platform availability, ease of use, performance characteristics with regards to accuracy, reliability, and robustness of algorithm implementation, customization options, ease of integration within the lab environment, and any hardware requirements/limitations. The results of the evaluation shall be reported to the TAM as an informal report transmitted electronically as either a text or MS Word file.

The Contractor shall track and report costs (hours) incurred in performing the work outlined in this section included in this section as one subtask in the weekly hour report.

8. Exhibit A

None required.

9. SPECIAL SECURITY REQUIREMENTS

UNCLASSIFIED unless otherwise specified by the customers utilizing the GEOLAB. Due to the proprietary nature of the data used in the GEOLAB, all contractor personnel assigned to work under this TA must be US citizens.

All contractor personnel assigned to this task must have their own user account and password on the available computer systems.

Data that is designated as limited exclusive rights distribution (LERD) or considered sensitive and/or proprietary will not be distributed to third parties without permission from the Requestor/data owner. Any ITAR restrictions will be marked and followed when directed by the appropriate program/project office or by the data owner.

At a minimum, the GEOLAB technical lead and at least one other GEOLAB staff member shall have secret clearances so that classified geometry and grid generation consultation and production tasks can be performed as required. Any classified work assigned to the GEOLAB will be performed onsite using workstations in a facility equipped to handle classified data provided by the GEOLAB customer with such requirements.

10. SOFTWARE ENGINEERING PROCESS REQUIREMENTS

The contractor shall follow the processes for software life-cycle development, stand-alone maintenance, or stand-alone operation, as specified according to the software control class in Task Assignment SL001. LMS center procedures, LMS-CP-5528, LMS-CP-5529, and LMS-CP-5532, shall be followed in that SPMPs, SCMPs, and test plans shall be prepared and maintained by the Contractor describing the approach to be taken for all software development activities in the GEOLAB. These documents are deliverables of this task assignment. Technical requirements, schedule, milestones, and cost for specific software tools shall be described in separate software summaries.

No software development tasks are expected during this performance period (2/1/08 - 4/27/09).

11. JOINT REVIEW SCHEDULE

There will be a joint review of the work being performed under this task assignment weekly. The technical monitor and all contractor personnel working on GEOLAB related projects are expected to attend. Task status, timeliness, and cost will be discussed. The Contractor shall record meeting notes and distribute these notes electronically.

12. PERIOD OF PERFORMANCE

This TA is effective from 04/01/04 to 04/27/09

13. TECHNICAL PERFORMANCE RATING

In evaluating Technical Performance, quality and timeliness shall be rated as follows:

Quality: 60% Timeliness: 40%

14. RESPONSE REQUIREMENTS

This Task Plan shall address the contractor's lead personnel, specific work plans, associated estimated labor hours, cost and schedule.

15. FUNDING INFORMATION

Funding last submitted on 08/15/2008.

16. MILESTONES

None required.

17. DELIVERABLES

Number	Deliverable Item	Deliverable Schedule
1	Subtask SPMP/Task plans and amendments	Per agreement with the TAM
2	Geometry, grids, map files, documentation, and test results	Per task plan
3	Geometry verification and data translation reports	Per task plan
4	Software and hardware evaluation reports	As required
5	Software source, make files, executables, documentation, and test suites	Per task plan

6	Software modification history	Recorded in CVS repository as modifications are developed and committed.
7	Surface Modelling and Grid Generation classes, tutorials, and training materials	Per task plan
8	Deliverables Summary	Within the first week of every month
9	Team Meeting notes	Within 3 business days following meeting
10	Notes from Joint Reviews with Customers	Within 1 business day following meeting; add to project file documentation.
11	Copies of papers and presentations	Per task plan
12	CFD flow solver results	Per task plan

18. FILE ATTACHMENTS

Others1